

# **PLAN OF WORK**



**Agricultural Research Division  
Institute of Agriculture and Natural Resources  
University of Nebraska**

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**Federal Fiscal Years**

**2000 to 2004**

**Plan of Work Outline**  
**University of Nebraska Agricultural Research Division**  
**FY 2000 to 2004**

- I. Introduction
- II. Matrix (5 Federal Goal Areas)
- III. Processes for Stakeholder Input
- IV. Merit and Peer Review Processes
- V. Multi-Institutional, Multi-Disciplinary, Multi-state and Integrated Research and Extension Activities

# Plan of Work

## I. INTRODUCTION

The University of Nebraska Agricultural Research Division (ARD) is also the Nebraska Agricultural Experiment Station. It is a division of the University of Nebraska Institute of Agriculture and Natural Resources (IANR).

This Plan of Work describes the planned research programs for the Agricultural Research Division (ARD) for the next five years, as required by the Agricultural Research, Extension, and Education Reform Act of 1998 (AREERA). It includes the elements identified in the USDA document, "Guidelines for Land Grant Institution - Plan of Work". The plan is based on the current strategic plan of IANR and on emerging issues identified through stakeholder input in anticipation of beginning the next revision of the IANR Strategic Plan. This Plan of Work is for the research programs only, but was developed in conjunction with University of Nebraska Cooperative Extension Division's Plan of Work.

In FY 98, Agricultural Research Expenditures in support of the programs described in this plan totaled \$52,533,403. Of this amount, Hatch Act Federal Formula Funds provided \$3,307,474 or 6.3% of the total funds expended.

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## II **MATRIX (5 Federal Goal Areas)**

**Goal I: To achieve an agricultural production system that is highly competitive in the global economy.**

### **Issue(s):**

Producing and processing crops and livestock are the mainstays of Nebraska's economy. IANR's research, education, extension and service programs have played an integral role in enhancing the competitiveness, increasing the profitability, and improving the sustainability of agriculture and agribusiness in the state. As the dynamics of the state's agricultural industry change in the next century, it will be even more important that IANR be prepared with research and education programs that bolster traditional agriculture while providing resources for alternative enterprises. It will continue to be important to address the entire cycle of food production, processing, marketing and consumption, integrating the concerns of the producer and the consumer to provide a safer and more sustainable food product.

Strong programs will be maintained in production, marketing and processing of the major livestock species, traditional field crops, and specialty crops such as dry edible beans and turf. Additional emphasis will be placed on developing production systems that are sustainable, environmentally benign, and conserve natural resources, yet profitable. New crops, increased instate production and processing, and development of new products and services also will be emphasized. Special attention will be given to integrated approaches for production, protection, and processing of Nebraska's commodities.

### **Nebraska Goals:**

1. Enhance animal and plant production systems to be more profitable and sustainable.
2. Support agribusiness and economic development, including product marketing and value-added processing of agricultural commodities.
3. Increase public/consumer understanding of food systems.

### **Output Indicators:**

1. Improved integrated systems for plant and animal production and protection.
2. New basic knowledge of importance to the improvement of plant and animal production systems.
3. Improved practices for conservation of resources and water and air quality protection.
4. New products and improved value-added processing of agricultural commodities and by-products.

5. Enhanced access for clients and consumers to research-based information about agriculture and natural resources.

**Outcome Indicators:**

1. Adoption of improved plant and animal genetic material by producers.
2. Improved marketing opportunities for Nebraska commodities and products.
3. Improved income level and stability for producers.
4. Growth in Nebraska-based value-added processing.
5. Improved levels of health and growth efficiency for agricultural plants and animals.
6. Greater public awareness and advocacy for research programs.

**Key Program Components:**

***Research:***

Efforts focused on:

1. plant and animal health.
2. new and improved industrial products from agricultural commodities.
3. basic understanding of plant and animal genetics and physiology.
4. more efficient use of production inputs.
5. prevention and/or minimizing of undesirable environmental impact.

***Joint Research/Extension:***

We have a combined Extension and Research team dealing with precision farming.

Extension has an Integrated Pest management (IPM) team and Research has several IPM projects. Team goals and project objectives are complimentary and some of the Extension team members are principal investigators on the Research projects. Several team members also carry joint Extension and Research appointments. There is also Extension and Research representation on a multi-state IPM committee.

**Internal and External Linkages:**

Research and Extension specialists, Extension Educators at the University of Nebraska-Lincoln, neighboring state institutions, commodity groups, Nebraska Independent Crop Consultants Association, seed fertilizer and pesticide suppliers, commercial pesticide applicators, Certified Crop Advisors.

**Target Audiences:**

Results will be usable by a broad range of agricultural producers and processors, from small to large in size. Nebraska-based processors, especially start-up companies will receive

highpriority.

**Program Duration:**

Our strategic planning and our ARD faculty project portfolio operate on 5-year cycles.

**Allocated Resources (\$ x 1,000) and SYs:**

	<i>Current</i>	<i>FY 2000</i>	<i>FY 2001</i>	<i>FY 2002</i>	<i>FY 2003</i>	<i>FY 2004</i>
<i>Funding:</i>	40,966	42,604	44,308	46,081	47,924	49,841
<i>SYs:</i>	100	98	97	96	95	94

## **Goal II: A Safe, Secure Food and Fiber System**

### **Issue(s):**

Providing a safe food supply is a common goal throughout the food chain from consumers, to food handlers, to food processors and food producers. This goal is upheld by the number of foodborne illnesses that occur in the United States. The USDA has estimated that in 1993, 3.6 to 7.1 million cases of foodborne illness occurred that resulted in 2,695 to 6,587 deaths. Several recent foodborne illness outbreaks (*E. coli* 0157:H7, Salmonella, Hepatitis A) in Nebraska emphasizes the need for education of food handlers on safe food handling techniques and the need for research to better identify and implement preventative controls to improve food safety.

The processing of Nebraska commodities of beef, pork, poultry, dairy, corn, soybeans, and other crops is represented by numerous large-medium-and small-size food processors. New technologies and management systems that enhance food safety and quality need to be developed. Listening sessions throughout Nebraska in recent months identified food safety as an increasing concern. Recent foodborne illness outbreaks in Nebraska have brought this to the forefront for consumers, food processors, and farmers/ranchers. Nebraska has experienced illness and hospitalization of individuals, the closing of meat packing plants, and restaurants sued as a result of breakdowns in the food safety chain.

Food safety has emerged as a very high priority research area nationally in recent years. Food animal production is a major component of the Nebraska economy and the Nebraska AES has a significant food safety research effort. Research faculty working in this area are working closely with the food industry and regulatory agencies to focus research efforts on the most critical problems as well as anticipated future issues. Efforts will be made to enhance the grant support in this area and to use interdisciplinary approaches to address all safety aspects of food production and handling.

### **Nebraska Goals:**

1. Animal and plant production systems and food processing and distribution systems will be enhanced to improve food safety and quality.
2. Research-based information will increase awareness of consumers, producers, food processors, food handlers and extension personnel on food safety issues and technologies.

### **Output Indicators:**

1. Enhanced research efforts on food safety and quality, especially from Nebraska commodities and including both pre-harvest and post-harvest technologies, with corresponding outputs of useful information.
2. Better broad-based collaboration to identify and assess technologies to enhance the production and processing components of food systems.

3. Increased understanding and utilization by food producers and processors of new technologies that enhance the safety and quality of foods.

**Outcome Indicators:**

1. Adoption of new and improved research-based food safety technologies by producers, food processors, food handlers, and consumers.
2. Reduction in the number of reported cases of foodborne illnesses.
3. Reduction in the number of food safety infractions in inspected food processing and handling establishments.

**Key Program Component(s):**

***Research:***

Research efforts focused on pre- and post-harvest aspects of plant and animal food safety. Emphasis will be on developing effective preventative measures to control foodborne pathogens prior to food reaching the consumer. .

***Joint Research/Extension:***

The University of Nebraska Research and Cooperative Extension Divisions of the IANR both have faculty teams addressing food safety. The teams have complimentary goals and overlapping membership with several team members carrying joint Research and Extension appointments.

**Internal and External Linkages:**

Partnerships will be maintained with Extension Educators, Researchers and Extension Specialists at the University of Nebraska and neighboring state institutions, commodity groups, food processing companies, Nebraska restaurant associations as well as restaurants in communities across the state, nursing homes, schools, state and local health departments, state department of agriculture, farmers, ranchers, and meat processors.

**Target Audiences:**

Research results will be used by agricultural producers, food processors, food handlers and consumers. Of particular importance are smaller meat and food processors and farmers/ranchers who produce milk, eggs, and meat animals for slaughter.

**Program Duration:**

Our strategic planning and our ARD faculty project portfolio operate on 5-year cycles.

**Allocated Resources (\$ x 1,000) and SYs:**

	<i>Current</i>	<i>FY 2000</i>	<i>FY 2001</i>	<i>FY 2002</i>	<i>FY 2003</i>	<i>FY 2004</i>
<i>Funding:</i>	2,210	2,298	2,390	2,486	2,585	2,688
<i>SYs:</i>	8.3	8.8	9.3	9.8	9.8	10.3

**Goal III: A Healthy, Well-nourished Population**

**Issues:**

The Nebraska 1993 Vital Statistics Report indicates the ten leading causes of death for adults in descending order are heart disease, cancer, cerebrovascular disease, pneumonia, accidents, chronic lung disease, diabetes mellitus, atherosclerosis, suicide and nephritis-nephrosis. Nebraska Health Profile 1994 data indicate the workplace death rate in Nebraska is significantly higher than the United States as a whole. Nebraska agricultural death rate is 35 per 100,000 agricultural workers compared to the national rate of 25 per 100,000. In addition there are an estimated 2400 Nebraska farm and ranch injuries annually which fall into categories of injuries caused by: 1) livestock, 2) machinery (excluding tractors and all terrain vehicles), 3) hand held and power tools, and 4) tractors. Injuries resulting in disability or functional limitations not only affect the income-producing potential of individuals but will increase hospitalization and rehabilitation costs for those same individuals and families.

More than half of Nebraskans have sedentary lifestyles, one-fourth are categorized as being overweight, and nearly one in five are hypertensive (Nebraska Behavioral Risk Factor Survey, 1991-1992). Alcohol misuse and tobacco use, including smokeless tobacco, are also prevalent in a significant portion of the Nebraska population. At the beginning of the life span, the Center for Disease Control has established that pregnancy outcome and health of infants are affected by ethnicity, maternal age, marital status, and socioeconomic status. Pregnancy Nutrition Surveillance System (PNSS) data gathered from 15 Nebraska WIC sites indicate that PNSS women are younger, less educated, more likely to be unmarried, and more likely to represent a minority group than the general Nebraska population of women giving birth.

Many of the above health concerns have nutritional implications, resulting in several researchable issues that can be addressed through ARD research programs.

**Nebraska Goal:**

To enhance the quality of life of individuals and families through healthy lifestyles including better nutrition and reduction of high-risk activity.

**Output Indicators:**

1. Improved knowledge of human nutrition and dietary habits of youth and adults
2. Improved knowledge of relationships between human nutrition and certain health problems.

3. New researched-based recommendations on nutritional practices to improve human health.
2. Enhanced collaborative education and demonstration programs on nutrition and safety, working with local state and federal agencies, schools, health care organizations, businesses, and others.

**Outcome Indicators:**

1. Incorporation of improved nutritional recommendations made by nutrition professionals.
2. Increase in consumer purchases and consumption of recommended food groups, including speciality items related to specific health issues.
3. Documented reduction in nutrition-related health problems in Nebraska.

**Key Program Components:**

Particular areas of emphasis include lipid metabolism, bioavailability of nutrients, eating behaviors and disorders, biochemistry of cardiac illnesses, and function of health care and family support systems.

Human health and nutrition research is a small component of the Nebraska AES portfolio, comprising under 1% of the expenditure and under 2% of the research faculty FTE. It remains an important area, however, and it is anticipated that this program area will have stable or modestly increasing resources. The nutrition research is also linked with animal nutrition research and the combined research faculty FTE in this area provides more than adequate critical mass for a strong research and education program in this area.

**Target Audiences:**

Research results can be used by a broad range of health care professionals, educators, food processors and marketers, and consumers of all ages.

**Internal and External Linkages:**

Partnerships will be maintained with Extension Educator, Researchers and Extension specialists at the University of Nebraska and collaborating land grant institutions, Department of Health and Human Services, Department of Education, appropriate legislators, appropriate health related entities such as the Nebraska Hospital Association. Additionally the other units of the University of Nebraska system such as the University of Nebraska Medical Center will be involved in this program.

**Program Duration:**

Our strategic planning and ARD faculty project portfolio operate on 5-year cycles.

**Allocated Resources (\$ x 1,000) and SYs:**

	<i>Current</i>	<i>FY 2000</i>	<i>FY 2001</i>	<i>FY 2002</i>	<i>FY 2003</i>	<i>FY 2004</i>
<b><i>Funding:</i></b>	4,630	4,815	5,008	5,208	5,406	5,633
<b><i>SYs:</i></b>	1.9	1.9	2.4	2.9	2.9	3.4

## **Goal IV: To Achieve Greater Harmony (Balance) Between Agriculture and the Environment**

### **Issue(s):**

Agricultural producers were some of the original stewards of the nation's natural resources. New knowledge of complex ecosystems, increased environmental regulations and policies, demands from consumers and a competitive world marketplace have changed the face of stewardship. There is a need for programs that equip producers with information and strategies enabling them to produce food, fiber and forest products in an environmentally benign and sustainable, yet economically viable, manner.

The quality of air, soil and water resources is critical not only to continued food production but to the overall well-being of all living things. Water quality and quantity are critical issues in Nebraska. Both surface and groundwater may be contaminated by agricultural, manufacturing and other human activities. Nebraska depends heavily on an adequate water supply. Uses such as irrigation, municipal supply, industry, and wildlife needs often conflict when water supplies are limited.

Despite many years of effort to improve management, soil erosion is continuing at unacceptable rates in some parts of Nebraska. Soil quality required for sustained productivity is threatened by outdated cultural practices, inappropriate land use, and improper waste disposal practices. Waste disposal continues to be an important issue of Nebraska, especially environmentally acceptable animal waste management.

Our knowledge of how ecosystems respond to environmental changes and management activities is extensive but narrowly focused. It must be broadened to better maintain the biological diversity of managed and natural ecosystems. To ensure a high quality environment for the future, Nebraskans must manage natural resources on a sustainable basis. Achieving a high quality environment requires well conceived and executed programs of research, education and service focused on youth and adult clientele, as well as extensive cooperation with federal and state agencies.

Research activities in support of Goal Area IV have increased in recent years as a result of redirected research resources and of improved external grant support. Improved natural resources management and environmental quality while maintaining a productive and profitable agricultural industry is identified clearly as one of the three major themes in the IANR strategic plan.

### **Nebraska Goals:**

1. Programs will focus on conserving and enhancing air, soil and water resources and improving environmental quality.
2. Improve ecosystem management for sustained productivity and enhanced biodiversity.

3. Provide information and expertise on natural resources and environmental issues that facilitate sound policy development and successful implementation programs.

**Output Indicators:**

1. Fully implemented Blue River Basin Project as an IANR Special Interdisciplinary Team effort in partnership with Kansas State University scientists.
2. A better understanding of processes leading to contamination of air, water and soil with development technologies to minimize resource degradation and remediate contamination where feasible.
3. Improved methods for use of animal waste.
4. Increased efficiency in the use of irrigation water by Nebraska producers through strengthened research and demonstration projects.
5. Development of integrated production systems that are profitable, yet sustainable and environmentally benign.
6. Development of management concepts for diverse ecosystems that focus on preservation or enhancement of landscape-level characteristics.
7. Improved natural resources management programs.

**Outcome Indicators:**

1. Use of ARD-generated research results by decision-makers as science-based information on which to base policy decisions.
2. Emergence of new School of Natural Resource Sciences as a leading academic unit dealing with natural resource systems in the Great Plains.
3. Adoption by producers of improved natural resource and waste management practices.
4. Improved surface and ground water quality related to changes in agricultural practices.
5. Documented improvement in irrigation water use efficiency.
6. Documented reduction in soil erosion from agricultural lands.

**Key Program Component(s):**

***Research***

Major areas of research emphasis include agricultural meteorology and climatology, water science and irrigation management, riparian zone ecology and management and remote sensing for natural resource management. Research is conducted in multiple departments and interdisciplinary research is strongly encouraged.

In 1997, IANR formed a new School of Natural Resources Sciences (SNRS) culminating several years of planning and organizing. The combined units forming the new school make this one of the strongest units of this type regionally and nationally. Significant resources

have been redirected into the SNRS, through the UNL reallocation process and through internal IANR allocations. External grants have been steadily increasing and the formation of the school should enhance that in the future. Multi-state efforts will increase. Overall, activities in support of Goal Area IV are expected to maintain a steady rate of increase in future years.

***Joint Research/Extension***

We have a combined Extension and Research team dealing with livestock and environmental issues. Extension has a water quality team and the Nebraska Agricultural Experiment Station has several water quality projects. Team goals and project objectives are complimentary and some of the Extension members are principal investigators on the research projects. Several team members also carry joint Extension and ARD appointments. There is also Extension and ARD representation on multi-state water quality committee and on the national manure management initiative.

**Internal and External Linkages:**

School of Natural Resource Sciences, School of Biological Sciences, Agronomy, Biological Systems Engineering, Agricultural Economics, Research and Extension Centers, Civil Engineering, Natural Resources Conservation Service, Nebraska Department of Agriculture, Nebraska Department of Environmental Quality, US EPA Region VII, Nebraska Commodity Boards, Nebraska Groundwater Foundation, and Natural Resources Districts.

**Target Audiences:**

Results will be used by agricultural producers, ranchers, irrigators, natural resource managers, technology transfer agencies, lawmakers, and others.

**Program Duration:**

Our strategic planning and our ARD faculty project portfolio operate on 5-year cycles.

**Allocated Resources (\$ x 1,000) and SYs:**

	<i>Current</i>	<i>FY 2000</i>	<i>FY 2001</i>	<i>FY 2002</i>	<i>FY 2003</i>	<i>FY 2004</i>
<b><i>Funding:</i></b>	10,260	10,670	11,097	11,541	12,003	12,483
<b><i>SYs:</i></b>	34	34	35	35	36	36

**Goal V: To Enhance Economic Opportunities and the Quality of Life Among Families and Communities**

**Issue(s):**

Both continuity and change are essential to a healthy society. IANR efforts to improve the quality of life of individuals, families and communities will continue to reflect societal change and needs.

Escalating pressures on children and families are related to two factors: changing demographics and public programs which provide support to working-poor families. The demography of Nebraska reflects greater cultural diversity, more older persons, declines in rural population, and more children and families living at poverty-level incomes. Welfare serves as a safety net for working-poor families, including child care, nutrition and food programs, housing and employment. Changes in welfare will affect many Nebraska families and households. New strategies must be developed to help families cope.

The youth of the nation are at risk due to infant mortality, poverty, poor communications and relationships within families, negative peer pressures as they relate to drug and alcohol use and abuse, sexual practices, and other antisocial behavior. IANR programs must be innovative in development and support of human capital development as a crucial resource for Nebraska's future.

As families, youth, and communities are impacted by technology, some communities are not able to keep up and consequently are left out of being economically viable places in which people want to live.

**Nebraska Goals:**

1. Enhance basic life skills among Nebraska's children, youth and adults.
2. Enhance business and liveable employment opportunities.

**Output Indicators:**

1. Strengthened individual and family capacity to overcome violence, youth violence, abuse, accidents and acts of nature crises.
2. Improved coping skills among children and youth in "at risk" situations.
3. Improved youth skills in examining ethical issues and applying ethical principles.
4. Identification of the factors characteristic of resilient families.
5. Enhanced entrepreneurial opportunities, business management and computer skills for small, home based and family-owned businesses.
6. Better socioeconomic data bases for communities, businesses, families and youth.
7. Strategies for economic resiliency among single- and dual-earner families.

**Outcome Indicators:**

1. Incorporation of new research based information in educational programs addressing family and individual living skills.
2. Expansion in the number of new businesses started and in the number of start-up businesses that are successful.
3. Enhanced opportunities for access to and training with modern technologies in rural and small communities.

**Key Program Components:*****Research***

This area is also one of the major themes of the IANR Strategic Plan. There are significant changes occurring in the rural area economics that create issues and problems for residents. Research is needed in many instances to help as input to program and policies in order to make the best decisions for the short and long term. Research programs can be expected to grow modestly, largely with help from external grants.

Areas of research emphasis include rural policy issues related to health care, affordable housing, and telecommunications. Family resiliency and coping skills of children and youth are additional areas of focus. Research is being conducted to develop socio-economic databases relative to communities, businesses, families, and youth to enhance development opportunities and improve leadership skills.

***Research and Extension***

Research programs are heavily linked to Cooperative Extension educational program activities. One current joint program is to assess and teach managerial and work force professional development interventions that increase employee retention, performance, and productivity.

**Internal and External Linkages**

Department of Health and Human Services, Departments of Education and Economic Development, school personnel such as teachers and principals, businesses, local public policy makers (i.e. city councils), youth-serving organizations such as FCLA and FFA, service organizations, Nebraska Enterprise Opportunity Network, National SARE Project, Nebraska Division of Technology, Center for Rural Affairs, Partners for Rural Nebraska, health care providers, child care providers, mental health agencies, and Family Preservation Teams.

**Target Audiences:**

Children and older youth, parents, teachers of elementary and secondary students, Extension Educators, people with ideas for businesses not yet in business, home-based business owners, main street businesses, agricultural producers, and social service agencies.

**Program Duration:**

Our strategic planning and our ARD faculty project portfolio operate on 5-year cycles.

**Allocated Resources (\$ x 1,000) and SYs:**

	<i>Current</i>	<i>FY 2000</i>	<i>FY 2001</i>	<i>FY 2002</i>	<i>FY 2003</i>	<i>FY 2004</i>
<i>Funding:</i>	1,371	1,426	1,483	1,542	1,603	1,668
<i>SYs:</i>	7	7	8	8	8	8

### **III. PROCESSES USED FOR STAKEHOLDER INPUT**

#### **Consulting with Stakeholders Regarding the Identification of Critical Issues in the State and Identification and Development of Programs Targeted to Address the Issues.**

The Agricultural Research Division and Cooperative Extension Division collaborate routinely in the development of programs. These Divisions, as part of the Institute of Agriculture and Natural Resources (IANR), have been partners in the development of strategic plans for over ten years. A systematic method of receiving input from clientele regarding "real world problems" is in place for the University of Nebraska Agricultural Research Division and Cooperative Extension Division.

The process used to gather input for this Plan of Work as well as the strategic plan of the Institute of Agriculture and Natural Resources was:

**1. Randomly drawn telephone survey under the direction of Wiese Research Associate, Inc.**

A systematic random sample of 203 consumer households and 151 farmers/ranchers across the State of Nebraska were interviewed by telephone. The total random sample of consumers was proportionately stratified according to gender, age and geographic area (i.e. county) to ensure a representative sample of this population within the state of Nebraska. Farmer/rancher respondents were randomly selected from a list of *Nebraska Farmer* subscribers. Quotas by county were established for this sample as well. Further, it should be noted that in order for a farmer/ranch to qualify for interview, at least 25% of their household's total family income had to be from farming or ranching. Finally, the questionnaires for each of these samples (consumer households and farmer/ranchers) were essentially identical, thereby allowing for a direct comparison between these two groups.

**1. Focus group interview of limited resource audiences under the direction of Wiese Research Associates, Inc.**

This effort was organized by an Extension Educator in Lancaster County, NE. Assistance was requested from the Lincoln Medical Education Pathways Program (LMEP), a residential self-sufficiency program. Extension Nutrition Advisors (EFNEP) assisted in the coordination of this effort. Extension Nutrition Advisors notified families with whom they work that their names might be drawn to participate in a focus group interview. The focus group was held at the LMEP where on site child care was available. The LMEF Pathways Program Coordinator helped in the selection of families by direct selection of individuals based upon their schedule availability. A late afternoon time was selected since many of the clients work or go to school. This site was selected because transportation was available and because focus group participants felt comfortable coming to this site. This group of individuals very much appreciated being invited to express their opinions. Each of those

participating was presented with a \$20 cash stipend for their participation.

2. **Listening sessions at nineteen sites across the state (one each in Omaha and Lincoln) and the other seventeen in communities statewide under the direction of the Special Projects Director, Institute of Agriculture and Natural Resources.**

Over 700 citizens participated. Individuals received written invitations, announcements were made over local radio and advertisements were run in local newspapers indicating that these “listening” sessions were open to the public. Participants included stakeholders, students, faculty and staff. Stakeholders represented all walks of life, white and blue collar workers, men, women and a limited number of minorities. The session participants represented gender and age diversity and a wide range of background and interests. Prior involvement with programs ranged from considerable to none. Sessions were two hours in length and included a brief background presentation. Teams of two to four IANR administrators listened to the facilitated discussions and responded to the questions as appropriate. An effort was made by the facilitator to motivate the participants to think into the future as well as the present.

3. **Cooperative Extension participated in the Nebraska Annual Social Indicators Surveys completed by the Bureau of Business Research at the University of Nebraska.**

Data was collected via telephone surveys from 1827 households. Data was weighted so the responses recreate Nebraskans according to age, sex, and geographic region. Similar programmatic issues (needs) were identified during each part of these four separate attempts to “listen” to the needs of residents of Nebraska that included over 2900 individuals. The Cooperative Extension Division and the Agricultural Research Division of the University of Nebraska Institute of Agriculture and Natural Resources (IANR) believe that issues identified in each of these four separate processes validates the program topics on which the Cooperative Extension Division and the Agricultural Research Division are working. Printed below are what we heard and the differences from the last time “listening” sessions were held in 1994.

1. **Mail-in survey of *Research Nebraska* readers.**

The Agricultural Research Division publishes a research publication reporting on current research activity of high interest and priority. This publication is sent to approximately 3,800 agricultural leaders and decision-makers throughout Nebraska. Periodic input on emerging research needs is obtained from *Research Nebraska* readers by inserting a tear-out mailer in the magazine which is sent back to ARD with readers’ opinions and responses to questions.

2. **External Advisory Panels**

Several IANR Departments, Interdisciplinary Centers, and program areas have external advisory

groups representing stakeholders and users which meet periodically and provide input on the current and future programs of the unit. One example of these is the external steering committee for the *E.coli* 0157:H7 food safety research program which includes several representatives from the beef industry, both producers and processors. Another example is the External Advisory Committee for the Agronomy Department which meets biannually to discuss Agronomy programs and provide feedback. These groups normally rotate membership at 2 or 3 year intervals, bringing new viewpoints regularly.

### WHAT WE HEARD IN 1999

- Communities: Need quality jobs in communities throughout the State to hold young people who have education and sl  
communities.
- Economy: Concern with the overall agricultural economy, particularly grain and livestock prices. Must compete in the g
- Families: Increased concern regarding the status of families from what we heard in 1994. Schools, services, family finances, nutrition, parents holding multiple jobs, lack of basic parenting and survival skills in young families, and schools given family responsibilities are among the issues.
- Lack of Control: A lot of uncertainty with increased complexity including global economics, regulations, change in rural l  
policies ranging from rules and regulations to legislation.
- Lifelong Learning: Wanted and needed. Bring the University programs out state. Use the information technology equi  
Educators to provide a connection to the total University.
- Livestock Industry: The trends in concentration, vertical integration, balancing supply with the domestic and internationa
- Population: The population is shifting from rural to urban areas; especially Lincoln and Omaha. With an aging populatio  
in rural areas.
- Research: Support for both basic and applied research. Request for more research in the rural and social sciences to focu  
private sector; and in environmental sciences on the interface between agriculture and environmental concerns.
- Water Quantity and Quality: These issues continue as high priorities. A particular concern is the quantity of water availab

### ISSUES SHOWING INCREASED CONCERN IN 1999

## Differences from 1994 Listening Sessions

- Agricultural Economy: Low profitability, evolving crisis situation. Difficult since the non-farm economy is doing very well
- Environmental Concerns
- Families and Communities: Related to families, youth, viable communities, quality of life
- Food Safety Issues
- Livestock Concentration Issues: Impact on the environment and communities
- Lack of Management Control: Increase in regulations, global markets - uncertainties

The Agricultural Research Division has worked to involve the under-served (women, racial and ethnic minorities, persons with disabilities and limited resource clientele) in the planning of programs. Approximately 10% of the state's population is identified as representing minority audiences. About 10% of the Nebraska population is in the poverty level income range.

For the nineteen listening sessions held across the state, special invitations were issued, i.e., to 1994 Land Grant College representatives and to targeted organizations, i.e., Women of Color to participate in one of the face-to-face sessions. In some locations, these were purposely scheduled at times when normal workday employees would be free to attend without missing work.

Efforts are made in selection of various external advisory group members to identify and appoint representatives of under-served populations. We maintain regular communication, and in some cases, cooperative programming with groups such as the Center for Rural Affairs and the Nebraska Sustainable Agriculture Association, which represent different sectors of agriculture and rural issues. The input from these groups tends to mirror the inputs from the nineteen listening sessions, although the advocacy groups often identify more specific areas of need. All of these inputs are conscientiously considered when programming decisions are made.

#### **IV MERIT AND PEER REVIEW PROCESSES:**

Every faculty member with a research appointment in the Agricultural Research Division is required to have a current approved peer-reviewed project which defines his or her area of research investigation. The Project Outline format is attached as Appendix I. The peer review process is consistent with the requirements of the Hatch Act as amended for agricultural experiment station projects. The peer review is required for all projects, whether they're classified as Hatch, State, or Multi-state (formerly regional). Appendix II is a copy of the guidelines for ARD project development and review. After internal departmental review, a peer review panel is appointed and convened to meet with the PI(s), Unit Administrators, and ARD representative. The recommended review questions are attached as Appendix III. Following review and acceptable revision, if necessary, the project outline is forwarded to USDA-CSREES for inclusion in the CRIS database.

Another review process which is a combination of merit and peer review is the review annually by several commodity check-off boards in Nebraska of over 100 funding proposals from ARD faculty. In selecting those proposals for funding which address the most significant problems currently being faced by the producer-members of these boards, there is a clear communication of the relevancy of the research to user needs. This is considered as valuable input to the ARD planning efforts.

## V. MULTI-INSTITUTIONAL, MULTI-DISCIPLINARY, MULTI-STATE AND INTEGRATED RESEARCH-EXTENSION ACTIVITIES

### Multi-Institutional and Multi-State:

The University of Nebraska is the only university in Nebraska that has a land-grant mission. The University of Nebraska's Institute of Agriculture and Natural Resources (IANR) is also the only Nebraska college or university authorized to deliver agriculture and agriculturally-related programs on a statewide basis. Nebraska has two 1994 land-grant colleges, but these do not currently maintain research programs, so there is no collaborative research underway with them.

Agricultural Research Division faculty currently have several active collaborative research efforts with faculty at the University of Nebraska Medical Center-Omaha (UNMC). The Ph.D. program offered by the IANR Department of Veterinary and Biomedical Sciences is joint with UNMC.

ARD faculty are involved in a large number of multi-institutional research efforts with universities located in other states. These include cooperative or collaborative arrangements of many types. Perhaps the most visible for many years has been the participation by ARD faculty in the former regional research program, under the partial support of the USDA regional research funds, now termed "multi-state". ARD faculty currently participate in 51 multi-state projects of the type eligible for funding support, and in all four of the national regions. They also participate in over 75 multi-state coordinating committees in the four regions, providing immense opportunities for faculty to do multi-state cooperative research. A listing of multi-state projects and committees with current ARD faculty participation is attached as Appendix IV. The ARD has actively encouraged meaningful participation in the multi-state activities.

The USDA funding received by ARD in the former regional research category is allocated on a project by project basis to specifically support faculty participation in multi-state research and to support travel for participation in multi-state committee meetings.

In FY 1998, ARD support for participation in regional research (multi-state) was as follows:

### ARD Expenditures in Support of Multi-State (Regional) Research for FY 98

Source of Funds	Expenditures
Federal Formula Funds	
Regional Research	\$827,444
Hatch	\$347,967
Federal Grant Funds	\$108,132
State Funds	\$2,493,031
Product Sales	\$623,158
Industry Grant Funds	\$128,160

Total	\$4,527,892
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From the above table, it can be noted that the Federal Regional Research funds provided about 18% of the total expenditures for multi-state research. The ARD commitment to formal multi-state efforts is significant, leveraging other support at over a 4 to 1 ratio compared to the regional research funds.

Federal Formula Funds spent on multi-state research for FY 98 totaled \$1,175,411 or about 35% of the total formula funds received by ARD of \$3,307,474. Funds from other sources spent on multi-state research totaled \$3,352,481 actually exceeding the total Federal Formula Funds received and expended by ARD in FY 98.

ARD faculty are also involved in numerous other multi-state activities that are not a part of the former regional research system. Many of these are with institutions in adjoining states, but many others with distant states or at institutions outside the USA. Some examples of the other current multi-state, multi-country activity follow:

The University of Nebraska and Kansas State University have teamed on a research and extension effort to reduce non-point source runoff pollution in the Blue River Basin area of southeast Nebraska and northeast Kansas. Faculty from Nebraska, Kansas State, Iowa State, and Missouri are working on a joint research project to make more effective use of standing forages by beef cattle grazing. Nebraska, Kansas State, and USDA scientists work together closely as part of the Central Plains Grain Sorghum Breeding Program. Nebraska faculty work with faculty from Kansas State and Oklahoma State as well as USDA scientists as participants in the Great Plains Cereals Biotechnology consortium.

At the western end of the state, Nebraska works with Colorado State and Wyoming Universities through the Central High Plains Dry Bean and Sugarbeet Group. This group recently prepared a Dry Bean Production Guide and is working on another for sugarbeets. Another collaboration with Wyoming and Colorado State resulted in the High Plains Integrated Pest Management Guide. Dryland cropping researchers from Nebraska, Colorado, Wyoming, and USDA have initiated several joint research trials.

On the international scene, examples of current multi-country research include participation by ARD faculty in two USAID-funded Collaborative Research Support Programs (CRSPs), the Bean/Cowpea CRSP, and the International Sorghum/Millet CRSP (INTSORMIL). In these CRSP activities, ARD faculty work with counterpart scientists in the Dominican Republic, Honduras, Puerto Rico, Mali, Niger, Botswana, Namibia, Zambia, and Zimbabwe.

The preceding examples are just a few of the extensive collaborative activities of ARD faculty with other scientists throughout the USA and world. There are also other collaborative relationships with industry scientists. These collaborations are important to enhance the productivity and expand the capabilities of the ARD research program.

### **Integrated Research and Extension Activities**

The Agricultural Research Division and the Cooperative Extension Division have a long tradition of working together. Currently, 96 ARD faculty hold a joint appointment between research and extension. The research component of these appointments range from .25 FTE to .85 FTE, but the average appointment is .5 FTE research and .5 FTE extension. About one-half of these faculty area located in five Research and Extension Centers across Nebraska. These are PhD. trained faculty in tenure leading positions regardless of location. These joint appointments are designed to ensure that Research-based knowledge can be incorporated into extension programs.

The approximate annual investment of ARD funds to support faculty with joint appointments with Cooperative Extension Division is as follows:

Appropriated State and Federal Funds	
Faculty Salaries and Fringe Benefits	\$4,660,000
Other Operating Support	3,325,000
Grant and Contract Funds	9,960,000

The approximate total annual ARD support for faculty with joint appointments (Integrated AES-CES activity) is \$17,945,000 which is about 34% of the total annual ARD expenditures for research.

For the near future, the Cooperative Extension Division and Agricultural Research Division have identified six priority areas where research and extension faculty will be working to enhance discoveries and strengthen education. These areas include:

- Food Safety (*refer to Goal 2 – Joint Extension/Research Program Component*)
- Integrated Pest Management (*refer to Goal 1 – Joint Extension/Research Program Component*)
- Manure Management (*refer to Goal 4 – Joint Extension/Research Program Component*)
- Precision Farming (*refer to Goal 1 – Joint Extension/Research Program Component*)
- Water Quality with Emphasis on Hypoxia (*refer to Goal 4 – Joint Extension/Research Program Component*)
- Workforce Preparation and Retention (*refer to Goal 5 – Joint Extension/Research Program Component*)

We have teams of faculty working on these critical issues. The teams have identified both research and extension goals they wish to achieve. Extension and research administrators have worked to help faculty on these teams strengthen already sound linkages between research and extension including joint funding of some programmatic goals.

#### **Multi-disciplinary Activities:**

Multi-disciplinary program activity is encouraged and there are several organizational arrangements that help support this. At the outstate Research and Extension Centers previously mentioned, the faculty include multiple disciplines at each center, usually with one or two faculty of each traditional discipline at

each center. They're involved in applied research and extension related to the needs of that particular area and multi-disciplinary activity is the normal approach.

Another mechanism to help foster multi-disciplinary activity are the IANR Interdisciplinary Centers. These include Centers for Biotechnology, Food Processing, Grassland Studies, Global Environmental Change, Industrial Agricultural Products, Rural Community Revitalization and Development, Sustainable Agricultural Systems, Water/Environmental Programs, and Communication and Information Technology. These centers serve to bring faculty together from diverse disciplines and departments to work together in dealing with problems that need multi-disciplinary solutions.

The Agricultural Research Division administers an interdisciplinary grant program which has an annual competition for interdisciplinary teams with the best proposals. Interdisciplinary team efforts are recognized and rewarded through the annual IANR Team Effort Award, given to the teams which have outstanding accomplishments.

The ARD administration believes strongly that the "multi" approaches – disciplinary, function, and state – are important to best address the needs of our stakeholders. While not appropriate for every type of research, we encourage these collaborations where possible and try to use resources and a reward system to help in this regard.

IANR is in the midst of developing a new strategic plan, based upon extensive stakeholder input at listening sessions held throughout the state in early 1999. The new strategic plan will encourage change and continuous improvement. By working as a team, we can make commitments needed to move the research, teaching, extension, and service programs of IANR toward higher levels of contribution in Nebraska, the nation, and the world.

**AGRICULTURAL RESEARCH DIVISION  
INSTITUTE OF AGRICULTURE AND NATURAL RESOURCES  
UNIVERSITY OF NEBRASKA-LINCOLN**

**FORMAT FOR RESEARCH PROJECT OUTLINES**

**I. PROJECT TITLE**

Briefly and clearly describe the nature of the proposed project (No more than 100 characters).

**II. PROJECT TYPE AND STATUS**

Project Type: State  Hatch  Regional Research   
McIntire Stennis  Animal Health

Project Status: Revised  New

If the proposal is for a revision, identify the current project number.

**III. PRINCIPAL INVESTOR(S), DEPARTMENTAL AFFILIATION(S), AND CURRENT APPOINTMENT**

Include co-leaders, but not cooperators (for example):

Dr. John Smith  
Department of Agronomy  
347 Keim Hall, ECU 0915  
jsmith1@unl.edu

0.75 FTE Research/0.25 FTE Teaching

[commitments on research appointment - eg., 0.10 FTE state project with Dr. Jones through 1993;  
0.10 FTE on regional project through 2002]

#### **IV. STATEMENT OF PROBLEM AND JUSTIFICATION**

Define the specific problem and/or need that the proposal will address, with particular emphasis on implications for Nebraska. If the proposal is for a revision, findings from the current project should be used to support the need for revision and continuation of a research project with similar objectives. Indicate the possible usefulness of the expected results and their potential impact. Project impact may include technological, economic, sociological, environmental, natural resource, or human resource considerations.

#### **V. RELEVANT PRIOR RESEARCH RESULTS AND CURRENT RESEARCH PROJECTS**

Briefly describe relevant previous research findings and project the current outlook for this research area based upon the research findings to date (including the current project if the proposal is for revision). Incorporate in this section a review of the literature and knowledge of on-going research based on a CRIS search and other appropriate information sources. Initiate a CRIS search on line at <http://cristel.nal.usda.gov:8080>. Include relationships to other research projects where applicable. Limit this section to one or two pages.

Support all references made to previous findings or published procedures in the proposal by adequate literature citations. The following formats are recommended for citing references in the narrative:

Haskins and Gorz (1998) reported...

or

... seasonal variation in leaf hydrocyanic acid potential  
(Haskins and Gorz, 1998).

References to specific pages of an article or book can be included in the parenthesis with the date. When a reference has more than two authors, use "Gorz et al., 1998" as the citation format.

#### **VI. V. OBJECTIVES**

Include concisely stated measurable objectives that are numbered in a logical order. The working hypothesis should be clearly stated. Objectives should be structured to allow immediate research activity while providing the flexibility over time to modify and refine project direction. The order of objectives should be defined by the priority needs of the proposed research and current and anticipated resources and funds. It may be appropriate to include general or overall objectives along with specific sub-objectives. Do not include procedures in this section.

## VII. PROCEDURES

The development of a research project outline is the basic instrument for planning and conducting research in ARD. A “Research Protocol Description” form has been included (**Appendix 1**) to assist the scientist in developing the research proposal. The research project outline should serve as a dynamic, working document; with frequent evaluation and alternation as new findings develop. The procedures section, particularly for the first year phase, should be as detailed as current planning allows with the understanding that procedural deviations are probable as the project progresses. Procedures should be correlated with specific objectives and appropriately noted.

A. First year or phases of project: If there are general procedures, present them first as an introduction. State the procedures separately and number to correspond with the respective objectives that occur within the initial year and/or phase. Incorporate appropriate literature citations where applicable. Procedures should include:

- \* location(s) where research is to be performed;
- \* data to be collected;
- \* parameters to be estimated or tested and their relationship to the objective;
- \* experimental units, important sources of variation, and relationship between these units and the population of inference;
- \* experimental or survey design;
- \* analytical methods including data analysis;
- additional facilities, space or equipment needs.

B. Procedure development: If a given procedure is conditional on the outcome of another procedure or if the procedure for accomplishing a particular objective must be first developed, state this and describe the plans by which this will be developed.

C. Second year or phase of the project through completion: Procedures and the explicit objective

are often dependent on the outcome of the initial experiments. Procedures for this phase of experimentation should include general plans for methods, where applicable.

## **VIII. WORK PLAN**

- A. Other Project Personnel: Describe the involvement of technicians and other support staff. This should include graduate assistantships available to the project. Indicate cooperators and advisers and describe their roles. Note here if the proposed research project contributes to an interdisciplinary research team approach. List the USDA or other stations, institutions, or agencies expected to cooperate formally or informally on this project. If the project is part of a regional project, list the Regional Research Project Number.
  
- B. Project duration and timetable: Include a flow chart of the chronology and approximate timetable for the proposed work by objective. Indicate clearly the work to be accomplish first.

	YEARS				
	1	2	3	4	5
Objective 1					
Item A	XXXXXXXXXXXXXXXXXX				
Item B		XXXXXXXXXXXXXXXXXXXX			
Objective 2					
Item A			XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX		
Item B				XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	
Objective 3					
Item A				XXXXXXXXXXXXXXXXXXXXXXXXXXXX	
Item B					XXXXXXXXXX

C. Dissemination of results: Describe plans for disseminating research results. Include these in the workplan.

## IX. ANTICIPATED OUTCOMES AND EVALUATION

Measures of output may include: papers published in scientific journals, research bulletins, extension publications, symposia/proceedings, or other written reports; papers presented at scientific meetings, conferences or workshops; patents; software; and variety releases.

Researchers are encouraged to consider opportunities for patenting, germplasm release or other intellectual property as significant outcomes.

Indicate ways the principal investigator(s) will determine status of progress toward objectives. Include plans for sharing evaluation with administrators on annual basis.

## X. LIST OF REFERENCES CITED

Arrange citations alphabetically by author and year. Use the following format:

Gorz, H. J., F.A. Haskins, R. Morris, and B. E. Johnson. 1998.

Identification of chromosomes that condition dhurrin content in sorghum rings. Crop Science

## XI. FINANCIAL SUPPORT

This section and the Approval section (XII) should be the last page of the project proposal.

The proposed budget should be on an annual basis and should be divided into three sections: “*Needs*”, “*Resources Available*”, and “*Resources Needed from Other Sources*”.

Opportunities for external funding to support aspects of the proposed research should be described.

Revolving funds are used for infrastructure (animals, feed, seed, fertilizer, chemicals, etc.) and should be shown, (as both a “*Needs*” and as “*Resources Available*”) but are not to be used for research operating.

Budgets should be described with reference to research objectives. The following is a suggested format:

<i>ITEM</i>	<i>Year 1</i>	<i>Year 2</i>	<i>Year 3</i>	<i>Year 4</i>	<i>Year 5</i>
<b><i>NEEDS:</i></b>					
Technologist	27,000	29,200	31,500	34,000	36,700
Labor	8,000	10,000	7,000	8,000	9,000
Graduate Student	0	0	26,600	29,300	32,200
Operations	5,800	18,500	11,500	4,500	4,000
Revolving Purchases	5000	5000	5000	6000	7000
Total	45,800	62,700	81,600	81,800	88,900
<b><i>RESOURCES AVAILABLE</i></b>					
Appropriated Funds	31,000	33,500	36,200	39,100	42,300
Revolving Funds	5,000	5,000	5,000	6,000	7,000
Current Grants	10,000	7,300	4,000	4,000	4,000
Total	46,000	45,800	45,200	49,100	53,300
<b><i>RESOURCES NEEDED</i></b>					
<b><i>FROM OTHER SOURCES:</i></b>	0	16,900	36,400	32,700	35,600

Funds are available from appropriated State and Hatch funds , income and revolving sources, and the grant to fully support work in Objective 1. Resources are inadequate to initiate the grazing research in Objective 4 due to seed and facility development expenses in 1998 (approximately \$14,000) but plot research and conduct of grazing research in Objective 4 can be supported with expected funds. In Objectives 2 and 3 a graduate student is needed for each objective in 1999-2000 as well as funds for special fence, water, and animal behavior measurement requirements and for analysis of samples collected.

It is unlikely that state and federal funds will be adequate to support the proposed research. It is expected that the Project leader will solicit external grant funds to support the research. The ARD research proposal should be an excellent basis from which to develop external grant proposals. The ARD publication entitled “Playing to Win” is an excellent resource for preparing and processing competitive grant proposals.



A:\ard format for research

(Research Project Outline - Appendix)

Agricultural Research Division

**Protocol Description Form for Project Proposals**

Objectives

Target Population

Experimental Unit (& Sampling Units, if any)

Crucial Response Variable(s)

Ancillary Response Variable(s)

Treatment Design

Experiment Design (randomization/assignment of e.u. to trt)

Replication & Power
Analysis - model and proposed procedures
Analysis - decision process (how analysis addresses objectives)

**Premise**

In a multi-year research proposal, exact description of all experiments cannot be provided because their content usually depends on the results of the first experiment. However, a project for which the first experiment cannot be described in reasonable detail is not ready for approval. This Protocol Description Form is designed to help researchers develop a workable plan for their *first experiment*. Researchers should find this form helpful as a tool for planning subsequent experiments, as well. [In medical research, grant proposals are not even considered unless accompanied by detailed protocol descriptions of this type]

**Objectives**

Objectives should be stated in the form of a question (or set of questions) to be answered or a decision to be made. Questions/decisions should be specific enough so the data from the experiment can provide answers. **Operating definitions** should be a part of any statement of objectives.

“Assess the effect of fertilizer on crops” is an objective, but it is too vague to be addressed by a single set of data (or a single project!!). “Estimate crop response to level of N applied” is better, but “crop response” needs an operating definition: how would we know crop response if we saw it? Yield? Disease resistance? Date of maturity? “Estimate” also needs an operating definition. Ordinarily it implies a functional relationship, e.g. a regression equation, between amount of N applied and response, but this needs to be clarified.

Most problems in data analysis result from vagueness in stating objectives.

### **Population of Inference**

When the research is done, *to whom* are the results to be presented and *to what* plants, animals, forests, rivers, feedlot operations, greenhouses, labs, etc. are the results intended to be applicable? Both “to whom” and “to what” issues affect how the research should be designed and how it is most appropriately analyzed and reported.

### **Experimental and Sampling Units**

The experimental unit is defined as the smallest physical entity to which a treatment category or level is *independently* applied. Sampling units are entities within the experimental unit that are measured. The most egregious errors in design result from failure to correctly identify the experimental units - such errors are often called “pseudo-replication.” Also, it is important that the experimental unit truly represent the population of inference.

## **Crucial Response Variable**

A response variable (or dependent variable) is the quantity or characteristic measured as a result of experimental manipulation. It may be a quantity (e.g. weight, yield, number of insects or animals) or it may be a classification (e.g. success/failure, poor/fair/good). The response variable is *crucial* if the main question to be answered or decision to be made by the experiment simply cannot be addressed without it.

Often, the crucial response variable needs an operating definition. “Weight” is relatively easy. “Weight gain” needs a bit of definition, e.g. over what period? “Feed efficiency” needs even more definition. “Vigor” or “stress” or “hostility” need even more. Many variables cannot be observed directly, so careful thought should be given to indirect measures. Are they being measured because it is possible or because there is a clear and scientifically convincing relationship between the *real* variable and the indirect measure?

There may be more than one crucial response variable in an experiment. However, a long list of crucial response variables is highly correlated with excessively vague objectives.

## **Ancillary Response Variable**

Many response variables are not essential to the primary research question, but they are “nice to know” and it seems a shame to go to all the trouble to conduct the experiment and not measure them “while we’re at it.” Ancillary variables may turn out to be crucial in subsequent research. However, many experimenters do contortions to collect and analyze ancillary variables at the expense of the crucial response variables.

## **Treatment Design**

The *treatment design* is the list of factors and their levels to be observed in the experiment. “Two treatments - control and treated” or “conventional till vs. reduced till” are treatment designs. So is a factorial design and a response surface design.

The treatment design should be a direct consequence of the objectives. It should be the minimum set of treatment conditions required to adequately answer the question or to make the decision.

## **Experiment Design**

The *experiment design* refers to the assignment of experimental units to treatment conditions. Completely random designs, randomized block designs, Latin Square designs are all examples of experiment designs. If blocking is used, the blocking criteria should be identified. Certain buzzwords,

such as “rep,” have been so abused that they no longer have a dependable meaning and should be avoided. It is better to give a clear description of how the experimental units are to be assigned to the treatments and how the experiment will be conducted and data collected than it is to give a name to the design.

### **Replication and Power**

“Replication” refers to the number of experimental units observed per treatment. It is often confused with the number of blocks in an experiment, but “replication” and “block” are not synonymous.

“Power” refers to the likelihood that a treatment effect of a given magnitude will be declared statistically significant if it exists. Power can be increased by increasing replication or by settling for only being able to detect larger treatment differences. In other words, if one wishes to detect relatively small treatment differences, more replication is required.

When an experiment is reviewed, power is one of the most critical factors. Most experiments are expensive and time-consuming. There is little point in going to the effort of conducting an experiment if it is unlikely to yield an answer to the question posed or decision to be made as stated in the objectives.

There are computer algorithms to determine approximate power of an experiment. These are taught in BIOM 802 and 902. It is worth noting that in medical research, granting agencies will not even consider research proposals submitted without a formal power analysis.

### **Analysis - model and proposed procedures**

Designed experiments typically have ANOVA’s which follow implicitly from the treatment and experiment design. The objectives imply certain mean comparison procedures or set of contrasts best suited to address the research objectives. For other studies, the appropriate procedures are less obvious and their choice is less “cut and dried.”

However, no researcher should ever be in the position of having the data and only then asking what the “correct” analysis should be. It is far too likely that it is too late at that point. Failure to have a well-conceived plan for data analysis is a gross failure of planning. “Appropriate statistical procedures will be used” is a euphemism for “I have no clue.”

### **Analysis - decision process**

This takes the proposed analysis and procedures a bit further by attaching interpretations to the various possible outcomes of the analysis. Often, a flowchart can be constructed specifying which tests

are to be done first and how to proceed given the results of preceding tests.

For example, in a factorial experiment, one would evaluate interactions first, and estimates or tests of main effects would only be meaningful if interactions are negligible. The researcher should relate the meaning of a negligible (or non-negligible) interaction to the research question(s) posed.

As another example, experiments with quantitative levels frequently use a partition of treatment effects into linear, quadratic, cubic, etc., components. A description of the decision process should give meaning to these components in terms of the objectives - e.g. what conclusion follows relative to the research question or what decision will be made if one decides the cubic effect is “significant.”

(March 16, 1998)

**AGRICULTURAL RESEARCH DIVISION**  
INSTITUTE OF AGRICULTURE AND NATURAL RESOURCES  
UNIVERSITY OF NEBRASKA-LINCOLN

**RESEARCH PROJECT DEVELOPMENT AND REVIEW PROCESS**

**The Research Project**

A research project defines an area of research investigation for each faculty member with a research appointment in the Agricultural Research Division (ARD). It establishes the general content and direction of the individual's research program and his/her responsibility to the research program of the administrative unit and ARD. Generally, research projects have a breadth that allows the flexibility required for long-term creative/scholarly activity; however, projects also should have short-term specificity to define measurable objectives.

**The Research Emphasis**

The faculty member is responsible for preparing the research project outline. Selection of a specific research area is influenced by:

- *Identified research needs of department, division, state and potential contributions to regional and nationally established research priorities*
- *Position description of the project leader*
- *Professional expertise, interest, and creativity of the scientist*
- *Resource capabilities available to the scientist*
- *Assessment of previous work and ongoing research by other scientists*
- *The IANR Strategic Plan and Unit Action Plans*

**The Research Project Outline**

The development of a research project outline is the basic instrument for planning and conducting research in ARD. The outline should serve as a dynamic, working document; with frequent evaluation

and alteration as new findings develop. It should clearly define some initial studies while allowing the scientist the opportunity to be visionary and the flexibility to alter the direction of research as new findings are developed. Outlines are seldom all inclusive of a researcher's total research activity, nor are they designed to be completely achievable within the proposed duration. Conceptually, an outline should challenge the scientist and expand research beyond its current level.

Research is progressive and depends on data from previous studies. It is just as important to conduct current research effectively, as it is to conceptualize future research needs. The project outline is designed to maximize the success of immediate implementation while providing the long-term flexibility for creativity. The project outlines should:

- *identify specific short-term research thrusts;*
- *provide flexibility for long-term planning;*
- *provide newly appointed faculty members the opportunity to define research areas which are achievable;*
- *provide established faculty the opportunity to formalize peer input on planned research activities and discuss direction and future research needs in the discipline area;*
- *focus research efforts into well-defined plans with measurable objectives for evaluating progress and accomplishments;*
- *ensure that a systematic search is conducted relative to current literature and research activity before initiating research;*
- *facilitate cooperative research and define contribution of collaborators in interdisciplinary research;*
- *assist administrators in budget planning, resource allocation, and identifying areas with potential for external funding;*
- *support the IANR Strategic Plan and Unit Action Plans;*
- *optimize the expected return from research effort invested by focusing activities on the specific, high priority needs in the state;*
- *provide input into the national computerized data base [Current Research and Information System (CRIS)] in agriculture, natural resources, and home economics; and*
- *provide input for "Endeavors", "Research Nebraska", and the "Pioneering the Future" data base.*

### **Essential Components of a Research Project Outline:**

- *Project Title*
- *Project Type [Hatch, State, Regional Research Projects or Nebraska contribution to a Regional Research Project; if a revision identify (eg. REVISED Hatch NEB xx-xxx)]*
- *Principal Investigator(s), Department Affiliation(s), and Current Appointment (include FTE commitment to regional research projects)*
- *Statement of Problem and Justification ( a proposal for a revision should address findings and outcomes of the current project that warrant a revision and continuation of research)*
- *Relevant Prior Research Results and Current Research Projects*
- *Objectives*

- *Procedures*
- *Work Plan*
- *Anticipate Outcomes and Evaluation Plan*
- *List of References Cited*
- *Financial Support (Available and Required)*
- *Approval Signature(s)*

A project outline is generally 8-10 pages in length. Refer to “Format for Research Project Outlines” which is available from ARD.

## New Research Projects

All new Hatch, State or Regional Research project proposals will be reviewed by the following process:

### Review Process for a New Project

1. **Informal Review:** The project leader is encouraged to seek council from colleagues with expertise in discipline area to critically evaluate proposed research.
2. **Department Review:** The project leader develops and submits the project outline to the Department/Chair for review and approval. It is recommended that the Department Head/Chair appoint an ad hoc departmental committee to review the proposal. The project leader is encouraged to suggest peer reviewers.
3. **Submission to Dean's Office:** After approval by the Department Head/Chair, the project outline is submitted by the project leader's Department Head/Chair to the Dean of the ARD.

Project outlines developed by faculty located at the district research and extension centers should also be approved by the Center Director before they are submitted by the Department Head to the Dean's Office.

The Department Head/Chair indicates in the letter of transmittal persons who have previously reviewed the project and names of individuals who may be qualified to serve on the ARD Peer Review Panel.

4. **Peer Review:** If the project outline appears acceptable, the Dean's Office appoints a peer review committee, schedules the review and sends each panel member a copy of the proposed project for evaluation before the review.

The Peer Review Panel includes the Department Head/Chair, District Director if applicable, and three or four faculty with project-related expertise. At least one reviewer should be from another department and the panel should include a person with statistical competence when appropriate.

Each member of the Peer Review Panel will be requested to complete a "Research Proposal

Peer Review Form” (see attached) prior to the meeting. The Peer Review Form will serve as a focus for the review and will give written suggestions for improving the research project outline.

A representative of the Dean's office chairs the peer review session. A typical review involves up to two hours of discussion and the reviewers are asked to give particular attention to the following questions which are posed in the Research Proposal Peer Review Form:

- *How important is the proposed research to the department ; research and extension center ,if applicable; division; institute; state; regional and nationally established research priorities and the discipline?*
- *Are the expected impacts and outcomes for ARD's stakeholders described?*
- *Overall, is the project clearly written?*
- *Are the objectives and procedures clear, complete, appropriate, and logically arranged statements of specific targets for the research to be conducted?*
- *Are the procedures matched to the objectives and include essential working plans and methods to be used in attaining the stated objectives?*
- *Are relevant previous work and current research adequately reviewed to indicate an awareness of the current state of knowledge and appropriately cited in developing the project? If this is a revised project outline, is the current project adequately cited to support continuation of research with similar objectives?*
- *Can the proposed work be accomplished within the constraints of resources (facilities, equipment, personnel and program support) available?*
- *Are there other potential collaborators for the project?*
- *Are the proposed research design, data analyses, and reporting plans adequate to meet the objectives of the proposal?*
- *Is the proposed research feasible (accomplishable), and is it feasible to accomplish the objectives within the stated period of time?*
- *Are there potential environmental, economic, and/or social impacts that should be considered as a part of the proposed research?*
- *Are there any potential patents, germplasm releases or other intellectual property that may arise from the project? Should these be protected?*
- *Considering the overall scientific quality of the proposal, should it be recommended for approval (with or without revision)?*
- *What specific suggestions would improve the proposal?*

If appropriate, the Peer Review Committee may require a rewrite to develop a more acceptable proposal. A major revision may be sent to the Peer Review Panel for final recommendation.

The Peer Review Panel can request a second meeting to discuss the proposal.

5. **Preparation of Final Outline and CRIS Forms:** If the Peer Review Panel agrees that the proposed research should be undertaken the project leader prepares a final project outline taking into consideration recommendations of the review committee. The Research Proposal Peer Review Form for each reviewer is submitted to the project leader(s) with any edited copies of the outline for consideration. The ARD representative will summarize specific comments in a letter to the project leader(s). The project leader(s) is expected to address all issues identified by the ARD representative in the transmittal letter of the revised project outline to the Department Head/Chair (through the REC Director, if applicable).

The project leader also prepares Current Research Information System (CRIS) forms for the project to provide input to the national computerized information bank of agricultural research projects. These forms are provided to the project leader by the Dean's office at the time of the peer review and include:

AD 416/417 Worksheet

Assurance Statement(s) CSRS 662.

If the project involves Recombinant DNA or RNA research, Vertebrate Animals or Human Subjects, you must have it approved by the appropriate university committee:

- **Recombinant DNA or RNA Research** - BioSafety Committee
- **Vertebrate Animals** - Institutional Animal Care and Use Committee (IACUC)
- **Human Subjects** - Institutional Review Board (IRB)

Each administrative unit should have a copy of the instruction manual for preparation of CRIS forms.

6. **Project Approval:**

- **Departmental Approval** - The project leader submits the revised project and CRIS forms to the Department Head/Chair (through REC Director, if applicable) for approval.

- **Approval by Dean's Office** - If the Department Head/Chair approves the revised project, the materials are submitted to the Dean's office.
- **USDA Approval** - If the project is approved by the Dean, it is submitted to the Administrator of the Cooperative State Research, Education and Extension Service (CSREES) for review and approval for expenditure of Federal funds. State projects are also forwarded to USDA for information and entry into CRIS.

### **Revised Research Projects**

A project leader may elect to revise an on-going research project outline instead of developing a new project outline if:

- the project outline is reviewed and approved **before** the termination date of the previous project;
- the research area remains a **high priority** for the investigator, department and ARD, and;
- the project **title** remains the **same** and project **objectives are similar** to the previous project.

### **Review Process for a Revised Project**

Revised projects were originally reviewed when the project was first initiated. A Modified Review will be used for on-going projects which are being revised. Review must be completed before the project termination date or else it will be handled as a new project.

1. **Informal Review:** Same as for a new project.
2. **Departmental Review:** Same as for a new project.
3. **Submission to the Dean's Office:** After approval by the Department Head/Chair, project outline is submitted by the project leader's Department Head/Chair to the Dean of ARD.

Project outlines developed by faculty located at the district research and extension centers should also be approved by the Center Director before they are submitted by the Department Head to the Dean's Office.

The Department Head/Chair indicates persons who have previously reviewed the project. A nontechnical “**Statement of Accomplishments**” should accompany the proposal when submitted to the Dean’s Office. This statement will be forwarded to the CIT. The statement should highlight the most significant results and should not exceed 250 words in length.

4. **Divisional Review:** The Division Review Panel will be chaired by the Dean’s Office representative and will include the Department Head, the District Center Director (if applicable) and the project leader(s). The same questions listed in the Peer Review section for a new project will be considered in evaluating revised projects including use of the “Research Proposal Peer Review Form.”
5. **Preparation of Final Outline and CRIS Forms:** Same as for a new project.
6. **Project Approval:** Same as for a new project.

## **Nebraska Contribution to a Regional Project**

Regional Research Projects were subjected to intensive review prior to their approval. The modified review is used to evaluate the Nebraska contribution to the regional project. The specific objectives and research protocol of the regional project that Nebraska researchers will address are reviewed. The entire regional research proposal should be submitted as an appendix to the work proposed for Nebraska.

### **Review Process for the Nebraska Contribution to a Regional Project**

1. **Informal Review:** Same as for new project.
2. **Departmental Review:** Same as for new project.
3. **Submission to the Dean of ARD:** Same as for a revised project excluding “Statement of Accomplishments”
4. **Divisional Review:** Same as for a revised project.
5. **Preparation of Final Outline and CRIS Forms:** Same as for a new project.

6. **Project Approval:** Same as for a new project.

### **Extension Of A Research Project**

A research project may be extended for up to one year past the termination date if additional time is needed to complete project objectives. A formal request must be initiated and justified by the project leader and approved and forwarded to ARD by the department head **30 days prior to the termination date**. Faculty at the Research and Extension Centers (REC) must transmit all correspondence through the REC Director. The Dean of the ARD will make the final decision on extending a project.

If an extension is granted, a revision of the project is no longer an option. At the end of the extension, the project must be terminated and new project proposal submitted.

### **Review Of Ongoing Projects**

The project leader and unit administrator (Department Head/Chair and REC Director, if applicable) are responsible for annual review of progress of on-going projects. This review normally occurs as part of the annual staff performance evaluation. Minor revisions may be made in the proposed research as a result of these discussions.

If the project leader, the unit administrator, or the Dean perceive a need to consider significant revisions in the project description or to provide additional input and advice concerning the project, a review committee may be assembled at any time during the life of the project.

AGRICULTURAL RESEARCH DIVISION  
INSTITUTE OF AGRICULTURE AND NATURAL RESOURCES  
UNIVERSITY OF NEBRASKA-LINCOLN

RESEARCH PROPOSAL PEER REVIEW FORM

**Principal Investigator:**

**Project Title:**

**Please provide, on a separate sheet if necessary, the information requested below for each question that is relevant to the research proposal:**

1. How important is the proposed research to the department ; research and extension center ,if applicable; division; institute; state; regional and nationally established research priorities and the discipline?
1. Are the expected impacts and outcomes for ARD's stakeholders described?
2. Overall, is the project clearly written?
3. Are the objectives and procedures clear, complete, appropriate, and logically arranged statements of specific targets for the research to be conducted?
4. Are the procedures matched to the objectives and include essential working plans and methods to be used in attaining the stated objectives?
5. Are relevant previous work and current research adequately reviewed to indicate an awareness of the current state of knowledge and appropriately cited in developing the project? If this is a revised project outline, is the current project adequately cited to support continuation of research with similar objectives?

7. Can the proposed work be accomplished within the constraints of resources (facilities, equipment, personnel and program support) available?
8. Are there other potential collaborators for the project?
9. Are the proposed research design, data analyses, and reporting plans adequate to meet the objectives of the proposal?
10. Is the proposed research feasible (accomplishable), and is it feasible to accomplish the objectives within the stated period of time?
11. Are there potential environmental, economic, and/or social impacts that should be considered as a part of the proposed research?
12. Are there any potential patents, germplasm releases or other intellectual property that may arise from the project? Should these be protected?
13. Considering the overall scientific quality of the proposal, should it be recommended for approval (with or without revision)?
14. What specific suggestions would improve the proposal?

*Appendix IV*

**Multi-State Research Committees with Current  
Agricultural Research Division Faculty Participation**

No.	Title	Participating Unit *
NC-7	Plant Germplasm Information Management and Utilization	Agron PHREC
NC-62	Prevention and Control of Enteric Diseases of Swine	VBS
NC-94	Climate and Agricultural Landscape Productivity Analysis and Assessment in the North Central Region	SNRS
NC-100	RRF Administration , Planning and Coordination	
NC-107	Bovine Respiratory Diseases: Risk factors, Pathogens, Diagnosis, and Management	VBS
NC-119	Management Systems for Improved Decision Making and Profitability of Dairy Herds	An Sci Ag Econ
NC-125	Biological Control of Soil-borne Plant Pathogens	Plant Path
NC-129	Fusarium Mycotoxins in Cereal Grains	Plant Path
NC-131	Molecular Mechanisms Regulating Skeletal Muscle Growth and Differentiation	An Sci
NC-136	Improvement of Thermal Processes for Foods	IAPC
NC-142	Regulation of Photosynthetic Processes	Biochem
NC-167	Role of n-3/n-6 Polyunsaturated Fatty Acids in Health Maintenance	NS&D
NC-170	Enhancing Health and Safety through Personal Protective Clothing	Home Ec
NC-189	Forage Protein Characterization and Utilization for Cattle	An Sci

NC-193	Spatial Dynamics of Leafhopper Pests and Their Management on Alfalfa	Ent
NC-197	Research in Support of a National Eradication Program for Pseudorabies	VBS
NC-202	Biological & Ecological basis for Weed Management Decision Support Systems to Reduce Herbicide Use	Agron
NC-205	Ecology and Management of European Corn Borer and other Stalk-boring Lepidoptera	NEREC Ent
NC-208	Impact Analysis and Decision Strategies for Agricultural Research	Ag Econ
NC-210	Positional and Functional Identification of Economically Important Genes in the Pig	An Sci
No.	Title	Participating Unit *
NC-213	Marketing and Delivery of Quality Cereals and Oilseeds	FS&T Agron
NC-215	Overwinter Survival of Heterodera, Pratylenchus, and Associated Nematodes in the NC Region	Plant Path PHREC
NC-217	The Role of Housing in Rural Community Viability	FCS
NC-218	Characterizing Nitrogen Mineralization and Availability in Crop Systems to Protect Water Resources	Agron
NC-219	Using Stages of Change Model to Promote Consumption of Grains, Vegetables, and Fruits by Young Adults	NS&D
NC-220	Integration of Quantitative and Molecular Technologies for Genetic Improvement of Pigs	An Sci
NC-222	Impact of Technology on Rural Consumer Access to Food and Fiber Products	TCD NS&D
NC-223	Rural Low-Income Families: Monitoring their Well-Being and Functioning in the Context of Welfare Reform	FCS

NC-224	Competitiveness and Value-Added in the U.S. Grain and Oilseed Industry	Ag Econ
NC-225	Improved Grazing Systems for Beef Cattle Production	An Sci
NC-226	Development for Pest Management Strategies for Forage Alfalfa Persistence	Ent Agron
NC-227	Ergot - a New Disease of U. S. Grain Sorghum	SCREC Agron
NC-228	Welfare Reform	FCS
NC-501	Ergot, a New Disease of U. S. Grain Sorghum	SCREC Agron
NC -----	Porcine Reproductive & Respiratory Syndrome	VBS
NCA-1	Crop Soil Research	Agron
NCA-2	Animal Health Advisory Committee	VBS
NCA-4	Horticultural Crops	Hort
NCA-5	Home Economics Research	Home Ec
NCA-6	Livestock Production	An Sci
NCA-10	Forestry and Forest Products	SNRS
No.	Title	Participating Unit *
NCA-12	Agricultural Economics	Ag Econ
NCA-14	Plant Pathology	Plant Path
NCA-15	Entomology and Economic Zoology	Ent
NCA-16	Agricultural Engineering	BSE
NCA-22 NCA-25	Food Science and Human Nutrition	FS&T NS&D
NCA-23	Fisheries and Wildlife	SNRS
NCA-24	Agricultural Education Research	AgLEC

NCR-3	Soil Survey	CSD
NCR-9	Midwest Plan Service	NEREC BSE
NCR-13	Soil Testing and Plant Analysis	Agron
NCR-21	Quantitative Genetics	An Sci Agron
NCR-25	Corn and Sorghum Diseases	Plant Path
NCR-31	Physiological Aspects of Forage Management	Agron
NCR-42	Swine Nutrition Committee	An Sci
NCR-46	Corn Rootworm	Ent
NCR-52	Family Economics	FCS
NCR-57	Reproductive Physiology	An Sci
NCR-59	Soil Organic Matter	Agron
NCR-65	Social Change in the Market Place: Consumer/Retail/Producer Interface	TCD
NCR-84	Potato Genetics	Hort
NCR-87	Beef Cow-Calf Nutrition and Management	An Sci
NCR-89	Confinement Management of Swine	NEREC An Sci
NCR-97	Regulation of Adipose Tissue Accretion in Meat Animals	An Sci
NCR-103	Specialized Soil Amendments, Products, Growth Stimulants, and Soil Fertility Management Systems	WCREC Agron
NCR-125	Biological Control of Arthropod Pests	SCREC Ent
NCR-137	Soybean Diseases	Plant Path
No.	Title	Participating Unit *
NCR-148	Migration and Dispersal of Agriculturally Important Biotic Agents	Ent

NCR-159	Expanded Utilization of Oilseeds in the Industrial Sector	IAPC, BSE
NCR-167	North Central Regional Corn Breeding Research Committee	Agron
NCR-168	Epidemiology and Economics of Animal Health Management	VBS
NCR-170	Research Advances in Agricultural Statisticians	Biometry
NCR-173	Genetics of Host-parasite Interactions Between Plants and Fungal Pathogens in the Genus Colletotricum	Plant Path
NCR-179	Agricultural and Rural Transportation Systems	Ag Econ
NCR-180	Site Specific Management	Agron SCREC
NCR-183	Utilization of Animal Manure and other Organic Residuals in Agriculture	NEREC Agron
NCR-184	Management of Head Scab of Small Grains	Plant Path
NCR-185	Optimizing Nutrient Intake by Feedlot Cattle for Growth, Retail Product, and Environmental Concerns	NEREC An Sci
NCR-187	Enteric Diseases of Poultry	VBS
NCR-189	Air Quality Issues Associated with Animal Facilities	BSE
NCR-192	North Central Regional Turfgrass	Hort
NCR-193	Maintaining Plant Health: Managing Insect Pests and Diseases of Landscape Plants	SNRS
NCR-194	Research on Cooperatives	Ag Econ
NCR-195	Mississippi River Watershed Nutrient Sources and Control	BSE

NCS-3	IPM - Soybeans and Swine Competitive Grant Guidelines	Agron
NCS-5	Water Quality Research Strategy and Coordination	Agron
No.	Title	Participating Unit *
NE-127	Biophysical Models for Poultry Production Systems	An Sci
NE-144	Forage Crop Genetics and Breeding to Improve Yield and Quality	Agron USDA-ARS
NE-165	Private Strategies, Public Policies, and Food System Performance	Ag Econ
NE-167	Family Business: Interaction in Work and Family Spheres	TCD
NRSP-1	Research Planning Using the Current Research Information System (CRIS)	ARD
NRSP-3	The National Atmospheric Deposition Program (NADP) - A long-term Monitoring Program in Support of Research Effects of Atmospheric Deposition	SNRS
NRSP-4	A National Agricultural Program to Clear Pest Control Agents for Minor Uses	Ent
NRSP-8	National Animal Genome Research Project	An Sci.
S-262	Diversity and Interactions of Beneficial Bacteria and Fungi in the Rhizosphere	Biochem
S-263	Enhancing Food Safety through Control of Food Borne Disease Agents	FS&T

S-272	Development of Textile Materials for Environmental Compatibility and Human Health and Safety	TCD
S-274	Integrated Management of Arthropod Pests of Livestock and Poultry	WCREC Ent
S-281	Dynamic Soybean Insect Management for Emerging Agricultural Technologies and Variable Environment	Ent
S-284	Genetic Enhancement of Health and Survival for Dairy Cattle	An Sci
W-143	Nutrient Bioavailability, A Key to Human Nutrition	NS&D
W-150	Genetic Improvement of Beans ( <i>Phaseolus vulgaris</i> L.) for Yield, Disease Resistance and Food Value	Hort
No.	Title	Participating Unit *
W-173	Stress Factors of Farm Animals and Their Effects on Performance	Biometry
W-177	Enhancing the Global Competitiveness of U S Red Meat	PHREC An Sci
W-186	Genetic Variability in the Cyst and Root Knot Nematodes	Plant Path
W-190	Water Conservation, Competition and Quality in Western Irrigated Agriculture	Ag Econ
WCC-11	Turfgrass Research	Hort
WCC-55	Rangeland Resource Economics and Policy	Ag Econ
WCC-60	Science and Management of Pesticide Resistance	Entomology
WCC-66	Integrated Management of Russian Wheat Aphid and Other Cereal Aphids	PHREC Ent

WCC-72	Agribusiness Research Emphasizing Competitiveness	Ag Econ
WCC-77	Biology and Control of Winter Annual Grass Weeds in Winter Wheat	PHREC Agron
WCC-92	Beef Cattle Energetics	An Sci
WCC-100	Implementation Strategies for National Beef Cattle Evaluation	USDA-ARS An Sci
WCC ___	By-Products Feedstuffs	An Sci

\* Unit Abbreviations

Ag Econ	Agricultural Economics
AgLEC	Agricultural Leadership, Education and Communication
Agron	Agronomy
An Sci	Animal Science
Biochem	Biochemistry
BSE	Biological Systems Engineering
Biometry	Biometry
CSD	Conservation and Survey Division
Ent	Entomology
FCS	Family and Consumer Science
FS&T	Food Science and Technology
Hort	Horticulture
IAPC	Industrial Ag Products Center
NS&D	Nutritional Science and Dietetics
Plant Path	Plant Pathology
SNRS	School of Natural Resource Sciences
TCD	Textiles, Clothing and Design

VBS	Veterinary and Biomedical Sciences
NEREC	Northeast Research and Extension Center
PREC	Panhandle Research and Extension Center
SCREC	South Central Research and Extension Center
WCREC	West Central Research and Extension Center